Abstract Title Page
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Title: The Targeted Reading Intervention: A classroom teacher professional development program to promote effective teaching for struggling readers in kindergarten and first grade

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Abstract Body

Background/context:
American schools have come under increasing scrutiny, largely because many children are not acquiring the skills they need to succeed in the larger culture (Grissmer, Flanagan, Kawata, & Williamson, 2000). The National Assessment of Educational Progress has reported that two thirds of fourth graders are not able to comprehend difficult texts and only 63% of fourth graders are reading at a very minimal level of proficiency. Of those families in poverty, only 28% of their children could read at this minimum level of proficiency in fourth grade (Lyon, 2001; Vaughn, Wanzek, Linen-Thompson, & Murray, 2007). These low levels of reading proficiency are especially true for rural children from low-wealth communities who come to school with lower readiness skills than other children (Lee & Burkam, 2003).

Rural schools' growing school populations and limited economic resources, combined with geographic isolation, make it difficult to provide teachers with the professional development skills to meet the needs of their most at-risk students (Dewees, 2000; Lee & Burkam, 2003; Roscigno & Crowley, 2001; Rural Policy Matters, 2007). Rural Schools also have limited access to web based technology that might enhance professional development and student learning (Lee & McIntire, 2000; Provasnik et al., 2007). These challenges by rural schools were underscored by a 2004 GAO report that sampled rural school principals (Government Accountability Office, 2004).

Rationale for the focus on Classroom Teacher Professional Development
Because of the overall poor reading achievement of children in elementary school but especially because of the poor reading achievement of children in poverty (NAEP, 2007), classroom teacher quality has been the focus of a number of descriptive studies and interventions in an attempt to improve the reading instruction of classroom teachers (U.S. Department of Education, 2004; Garet et al., 2008; Risko et al., 2008; No Child Left Behind Act of 2001, Public Law 107-110). Studies that have examined distal characteristics of teacher quality (such as teacher qualifications, education, and experience) have shown rather weak prediction to student reading outcomes, especially for low-income students who are at such high risk for reading failure (Kainz & Vernon-Feagans, 2007). Thus, emphasis has been placed on developing and evaluating professional development programs for teachers that might improve their reading instructional practices. Reviews of these previous professional development efforts to enhance classroom teachers' instruction with struggling readers have been largely unsuccessful (Al Otaiba & Fuchs, 2006; Gersten, Morvant, & Brengelman, 1995). IES recently completed one of the largest randomized clinical trials ever conducted to assess the efficacy of professional development in early reading for classroom teachers (Garet et al., 2008). Although teacher knowledge and practice improved over the school year in both intervention groups in comparison to the control group, there were no reading achievement differences between the experimental and control group children.

There is some evidence in the teacher quality literature that might help explain these lack of child gains. In a recent review of the research on regular classroom teacher preparation programs (Risko et al., 2008), it was concluded that intensive teacher training programs that emphasize "learning while doing" can produce better teacher knowledge, beliefs and practices in

comparison to programs that only emphasize knowledge and beliefs. Further, they found through analysis of a number of studies, that pedagogical knowledge that is developed when teaching one student can accelerate teacher knowledge and transfer to better classroom instruction (Massey, 1990; Moran et al., 2006). In addition, recent Response to Intervention research in the Special Education literature has emphasized individual diagnostic teaching, even for classroom teachers (Gersten & Dimino, 2006; Speece et al., 2003). For instance, Speece and her colleagues (2003) found that children who were impaired readers could be helped by the classroom teacher with intensive consultation from research staff. Other specific professional development programs, such as the *Interactive Strategies Approach* (Scanlon & Vellutino, 2004), have specifically addressed classroom teacher individualization of instruction for struggling readers and have found significant gains in reading for children (Scanlon et al., 2008). Thus, we believe that the TRI has used the information provided by these studies in developing a particularly effective professional development program for classroom teachers.

The Content of the TRI intervention for Struggling Readers

The TRI incorporates the elements identified in the research on professional development for classroom teachers and elements of effective teaching for struggling readers based on our model of teacher change (See Figure 1). The TRI has a number of unique elements. ***First,*** unlike many other interventions, the TRI uses the classroom teacher to deliver the intervention to each individual struggling reader through efficient, diagnostic one-on-one instructional sessions. ***Second,*** the TRI iterative process of the teacher working with one struggling reader is hypothesized to be the basis for teacher learning and change. ***Third,*** the TRI uses an innovative web-based collaborative consultation model. Weekly, each TRI teacher uses a laptop computer with a webcam in her classroom so that she can see and hear us and we can see and hear her working with an individual struggling reader. Real time feedback and problem solving can be employed during these live sessions for individual children.

Purpose / objective / research question / focus of study:

The research questions were the following: (1) Did focal struggling students in experimental schools who received the Targeted Reading Intervention from their classroom teachers, supported by a coach via webcam technology, perform at a higher level on spring reading/language outcome scores than the focal struggling students in control schools, when controlling for fall entry scores? (2) Were struggling focal students who received the TRI able to "catch up" with their non-struggling peers (non-focal children) by the end of the school year?

Setting:

Sixteen rural schools from five rural counties in the United States participated in the study. All kindergarten and first grade classrooms in each school participated. Difficulties with technology led to the withdrawal of one school. The fifteen remaining participating schools included 75 kindergarten and first grade classrooms and 648 students. All schools received Title I funding.

Population / Participants / Subjects:

The demographics of the 648 children in the study are described in Table 1 . Since all schools were Title 1 schools, maternal education of these children was generally a high school degree with few parents completing college. Approximately 50% of the children were from minority backgrounds and half were boys. Teacher demographics are shown in Table 2 and are consistent

with literature on rural schools. Teachers had more years of experience than urban teachers, with an average of 15 years of teaching experience (Lee & Burkham, 2002).

Intervention / Program / Practice:
The main objective of the overall Targeted Reading Intervention (TRI) was to help the classroom teacher acquire the key reading diagnostic strategies (e.g., Cooter, 2003; Desimone, 2009; Garet et al., 2001; Timperley & Phillips, 2003) relevant to K-1 struggling readers (e.g., Desimone, 2009; Garet et al., 2001; Guskey, 2002; Joyce & Showers, 2002; Penuel et al., 2007; Taylor, Pressley & Pearson, 2004) through our professional development program. In the present study we employed an innovative distance technology model to deliver professional development and real-time collaborative coaching to isolated rural schools. Each experimental classroom received a laptop, webcam, and webconferencing software. This technology was used with each experimental teacher so that we could see and hear her working with each of her struggling readers in real time and she could see and hear the literacy consultants at our university thousands of miles away. Through this technology the literacy consultants could coach the classroom teacher in using the TRI strategies and also use the technology of grade level meetings and workshops throughout the year.

The TRI is initially a 15-minute one-on-one session between the classroom teacher and the child that can begin even if the child has no letter-sound knowledge. Diagnostic information based on the DIBELS and other teacher diagnostic information is discussed with the consultant to decide what strategies would be most appropriate for an individual child. Each teacher uses a diagnostic map (See Figure 2) to chart the child's daily progress and match this with appropriate strategies. As the child makes rapid progress, the teacher can opt to continue the intervention in small group sessions and move on to one-on-one instruction with another struggling reader. Each 15-minute session includes the following: ***1.Re-Reading for Fluency:*** The teacher asks the student to re-read a selection that she/he has read at least once the previous day for the purpose of developing reading fluency. ***2. Word Work***: This innovative approach provides the teacher with a variety of assessment based multi-sensory instructional strategies for helping the child manipulate, say, and write words (Bear, Invernizzi, Templeton, & Johnston, 2003; Beck, 2006; Clay, 1993; Dwyer, 2004; McCandliss, Beck, Sandak, & Perfetti, 2003; McGuinness, 1997; Moats, 1998; Morris, Tyner, & Perney, 2000). ***Guided Oral Reading (GOR)***: Strategies are employed in a text chosen at the child's instructional reading level, as guided by the *Word Work.* We distinguish TRI GOR from contemporary guided reading in small group classroom instruction in two ways. *First*, the text is more closely matched to the individual student's needs, particularly because of the one-on-one setting. *Second,* TRI teachers offer greater focus to word-level, moment-by-moment coaching, as well as a focus on fluency and comprehension strategies.

Research Design:
Because of the small number of schools, schools within each district were paired matched based on demographic characteristics (size, % minority, Reading First participation and % free and reduced lunch) and randomly assigned to the experimental or control condition. Within each experimental and control classroom teachers, with the help of our literacy consultants, identified children who were struggling and non-struggling readers with the help of mandated state assessment data and classroom performance within 2 months of the beginning of the school year. Based on this information, we randomly selected 5 struggling readers (focal children) and five

non-struggling children (non-focal children) in each classroom. We defined four groups of children for analysis purposes and to test hypotheses about the effectiveness of the TRI: *Experimental Focal* (struggling students in TRI classrooms), *Experimental Non-Focal* (non-struggling students in TRI classrooms), *Control Focal* (struggling students in non-TRI classrooms), *Control Non-Focal* (non-struggling students in non-TRI classrooms). There were 194 focal students in the experimental schools and 116 focal children in the control schools. There were 206 non-focal children in the experimental schools and 132 non-focal children in the control schools.

Data Collection and Analysis:

Children were pretested in the fall and post tested in the Spring on the *Peabody Picture Vocabulary Test* (PPVT) and the Woodcock Johnson Tests of Achievement (WJ-III) subtests, including *Word Attack, Letter/Word Identification, Passage Comprehension*, and *Spelling of Sounds*. Teacher fidelity was assessed through weekly online reporting procedures and ratings of quality by our literacy consultants over the course of the year. Fidelity was at or above 80% for all teachers over the year.

To avoid imprecise estimation due to missing data we created and analyzed multiple imputed datasets in SAS v. 9.1. Multiple imputation procedures use an iterative (chained equations) method to estimate the multivariate relations among study variables for cases with available data. These observed relations among study variables are then used to estimate plausible values for missing data. Creating multiple datasets with plausible values for missing data and aggregating solutions from analyses using multiple datasets provides the best approximation of relations among variables given no missing data (Graham, Olchowski, & Gilreath, 2007; Shafer & Graham, 2002). Consequently, the ANCOVA models presented below were run on each of 20 imputed datasets and model parameters were aggregated across the datasets using the PROC MIANALYZE function in SAS. The imputation model included: fall and spring assessment scores for all outcomes, child grade, child race (white, black), child gender, mother's education, and dummy variables indicating school id and randomized treatment status.

Multi-level (hierarchical) ANCOVA models were used to test whether randomly assigned treatment increased literacy skills and promoted catch-up for struggling readers. Separate models were conducted for each of five outcomes: Spelling of Sounds, Letter Word ID, Word Attack, Passage Comprehension, and PPVT. Because preliminary three-level ANCOVA (students nested in classrooms, classrooms nested in schools) indicated non-significant variation between schools and between classrooms within schools, we dropped the school level from the analysis. Two-level models yielded significant variation at level one and level two. Consequently, all models were estimated in SAS v. 9.1 as two-level ANCOVA accounting for the nesting of students within classrooms. Effect sizes for significant treatment effects were calculated by dividing the comparison coefficient (mean difference) by the square root of total variation in the model.

The two-level ANCOVA predicted spring scores as a function of a four-category treatment fixed effect at level two, fall pre-test scores as a fixed effect at level one, and a set of level-one fixed effects used as covariates across all models: gender is male, mother's years of education, grade (k = 0, first = 1), and race is white. This model estimated random effects for classroom intercepts. All covariates including the pre-test were centered for analysis, so that the intercept in the models reflected average spring scores for the treatment reference group,

experimental focal students. Treatment effects were established by estimating the significance of the conditional mean difference between spring scores for focal experimental and focal control students. Catch-up was established given three simultaneous events: 1) non-significant differences between conditional spring scores for non-focal experimental and non-focal control students (non-focal students performing similarly despite school treatment status); 2) non-significant differences between conditional spring scores for focal and non-focal students in experimental classrooms (non-focal and focal students performing similarly in treatment classrooms); and 3) significant differences between conditional spring scores for focal and non-focal students in control classrooms (non-focal students outperforming focal students in control classrooms). The reduced form equation for the model is:

$$Y_{ij} = \gamma_{00} + \gamma_{01}(\text{pre-test})_{ij}\ \gamma_{02}(\text{treatment})_{j} + \gamma_{03}(\text{male})_{ij} + \gamma_{04}(\text{mother's ed.})_{ij} + \gamma_{05}(\text{grade})_{ij} + \gamma_{06}(\text{white})_{ij} + u_{0j} + r_{ij}$$

In this notation, fixed effects are represented by gammas (γ), and random effects are reflected in the two error terms; a term for level-two variation between classrooms (u_{0j}) and a term for level-one variation between students within classrooms (r_{ij}).

Findings / Results:

Question 1: Did the focal children in experimental schools outperform the focal children in control schools? Controlling for differences in pre-test scores TRI had a positive effect on struggling readers' Word Attack (WA), Letter Word ID (LWI) , and Passage Comprehension(PC) and Spelling of Sounds(SS). FE Word Attack Spring scores were approximately 5.86 points higher than FC students' scores ($p = .01$). FE LWI Spring scores were approximately 9.32 points higher than FC students' scores ($p < .0001$). FE PC Spring scores were approximately 9.04 points higher than FC students' scores ($p < .0001$). FE SS Spring scores were approximately 3.14 points higher than FC students' scores ($p = .01$). There was no evidence that TRI had a positive effect on PPVT skills.

Question 2: Did the focal children in experimental schools catch up with the non-focal experimental children in experimental schools?. In general FE students caught up to NFE students as evidenced by a non-significant difference in Spring performance for LWI, WA, and SS. However, there was no evidence that TRI promoted catch-up on Passage Comprehension or the PPVT.

Above and beyond intervention effects, male students had lower Spring WA and LWI scores. Above and beyond intervention effects students with higher maternal education had higher Spring Passage Comprehension, Spelling of Sounds and PPVT scores.

Conclusions:

This study suggests that the Targeted Reading Intervention, using webcam technology with classroom teachers in kindergarten and first grade, can significantly help struggling readers progress more quickly in all of the basic word reading and comprehension skills over one year. In addition, for the basic word reading skills, the TRI can actually help struggling readers catch up with their non-struggling peers in the same classroom by the end of the school year. Future work is needed to understand what actual teacher knowledge and practice constructs that might mediate the relationship between treatment and student outcomes.

Appendices

Not included in page count.

Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures

Figure 1. Mechanisms of Change for the *Targeted Reading Intervention*

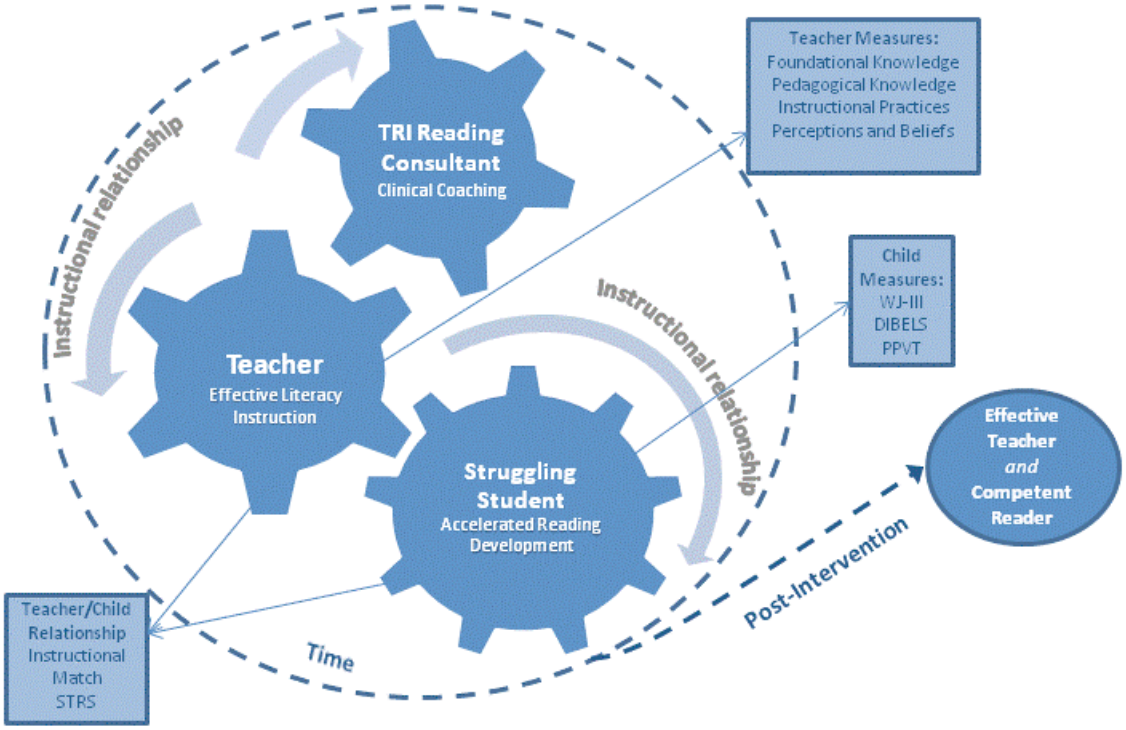

Table 1

		Kindergarten				First Grade			
	Group n =	*NFC 60*	*FC 60*	*NFE 95*	*FE 91*	*NFC 72*	*FC 56*	*NFE 111*	*FE 103*
Male	*%*	0.60	0.65	0.56	0.56	0.51	0.71	0.33	0.54
White	*%*	0.58	0.35	0.53	0.55	0.56	0.29	0.47	0.45
Maternal Ed	*N*	55	53	92	80	68	45	102	95
	Mean	14.18	12.68	13.63	13.08	13.74	13.20	13.53	12.99
	Std	2.01	2.25	2.12	2.34	2.21	2.02	2.39	2.37
Fall PPVT	*N*	45	45	81	78	67	43	108	102
	Mean	102.84	94.33	97.54	90.15	98.22	87.47	97.59	90.77
	Std	13.85	15.04	12.77	14.43	14.32	15.26	12.92	12.43
Fall wa w score	*N*	50	48	81	77	69	45	106	102
	Mean	427.12	411.17	430.16	410.56	468.06	449.76	470.25	455.02
	Std	20.03	19.33	22.45	23.59	19.21	19.45	17.11	19.76
Fall lw w score	*N*	51	48	81	78	68	45	108	102
	Mean	373.06	353.79	376.54	354.95	424.90	400.38	430.95	406.10
	Std	22.38	21.75	23.69	22.87	27.24	19.47	25.72	19.51
Fall passage comprehension w score	*N*	51	48	81	78	69	45	108	102
	Mean	411.76	404.94	408.83	403.00	449.48	430.09	454.80	431.38
	Std	18.16	13.55	19.87	13.62	26.54	16.85	20.90	20.19
Fall spelling of sounds w score	*N*	51	48	76	76	69	45	108	102
	Mean	465.02	446.56	467.37	449.14	490.33	482.98	491.29	484.65
	Std	20.00	18.34	15.42	17.96	8.26	12.13	7.54	9.12
Spring ppvt	*N*	54	51	88	84	69	42	104	92
	Mean	105.00	96.63	100.49	95.94	103.22	93.00	100.68	91.66
	Std	17.27	12.63	13.84	11.43	15.20	15.36	15.55	14.57
Spring wa w score	*N*	54	51	88	84	69	42	104	92
	Mean	460.37	449.10	465.24	456.35	482.64	466.76	485.02	474.21
	Std	17.34	20.83	17.95	21.74	15.35	17.62	18.98	16.77
Spring lw w score	*N*	54	51	88	84	68	39	104	92
	Mean	408.93	390.31	418.39	403.10	458.49	434.33	463.85	442.90
	Std	21.26	16.75	22.70	22.34	23.71	21.42	22.03	19.43
Spring passage comprehension w score	*N*	54	51	87	84	69	42	104	92
	Mean	435.98	417.27	445.06	429.14	472.84	455.17	475.08	461.92
	Std	22.94	18.89	22.09	21.04	13.09	17.35	12.39	14.45
Spring spelling of sounds w	*N*	54	51	88	83	69	42	104	91
	Mean	484.35	477.82	489.73	483.75	498.75	491.74	497.21	494.30

score	*Std*	10.49	13.99	6.87	10.65	5.11	9.19	8.41	6.25

Table 2

	Treatment n = 43			Control n = 32		
Variable	N	*M*	*SD*	N	*M*	*SD*
Race						
Black/African American	6			4		
White/European American	35			25		
Other	1			3		
Missing	1					
Gender						
Female (1 missing treated)	41			32		
Age[a]						
20-29	6			8		
30-39	11			8		
40-49	12			8		
50-59	11			7		
60+	3			1		
Certification Level						
Elementary Ed. Certified	40			28		
Master's Degree or higher	10			22		
Experience						
Total years teaching		17.60	10.77		13.33	9.69
Total years teaching current		8.95	7.88		5.31	8.95

grade				
Total years teaching at current school	8.00	5.59	7.45	8.00
Total years teaching in current county	12.53	8.93	9.45	8.56

Table 3

	WA				LW				PC			
Fixed Effects	*B*	*SE*	*p*	*d*	*B*	*SE*	*p*	*d*	*B*	*SE*	*p*	*d*
Pretest	0.469863	0.033188	<.0001	-	0.648442	0.029636	<.0001		0.330427	0.034872	<.0001	
White	0.782894	1.514372	0.6054	-	1.283883	1.469429	0.3827	-	3.845776	1.456718	0.0084	-
Male	-4.104075	1.275197	0.0013	-	-3.091263	1.248577	0.0134	-	-2.139591	1.298329	0.0995	-
Maternal ed.	0.509692	0.321357	0.1131	-	0.559926	0.335349	0.0962	-	1.535073	0.336803	<.0001	-
Grade	0.423815	2.180749	0.8459	-	11.496831	2.491807	<.0001	-	22.175534	2.124182	<.0001	-
Non-focal control (nfc)	-0.911367	2.186574	0.6768	-	-1.063372	2.330037	0.6481	-	2.850139	2.188150	0.1928	-
Focal control (fc)	-5.861903	2.288381	0.0105	-	-9.320061	2.357348	<.0001	-	-9.035825	2.277397	<.0001	-
Non-focal exp. (nfe)	0.976793	1.714447	0.5690	-	2.352175	1.618108	0.1462	-	7.901098	1.658964	<.0001	-
Random Effects												
Level 2 Variation	24.479512	9.231337	0.0080	-	40.360290	11.657927	0.0005	-	26.950676	9.314381	0.0038	
Level 1 Variation	219.428481	14.142104	<.0001	-	194.713401	12.694426	<.0001	-	218.062276	14.241797	<.0001	
Comparisons												

FE vs FC	5.861903	2.288381	0.0105		9.320061	2.357348	<.0001	-	9.035825	2.277397	<.0001	-
FE vs NFE	-0.976793	1.714447	0.5690	-	-2.352175	1.618108	0.1462	-	-7.901098	1.658964	<.0001	-
FC vs NFC	-4.950536	2.178652	0.0232		-8.256688	2.077556	<.0001		-11.885964	2.078751	<.0001	
NFE vs NFC:	1.888160	2.117013	0.3725		3.415547	2.225116	0.1248		5.050959	2.131048	0.0178	

Table 3 Contd.

	SS				PPVT			
Fixed Effects	*B*	*SE*	*p*	*d*	*B*	*SE*	*p*	*d*
Pretest	0.316731	0.024918	<.0001		0.627670	0.036542	<.0001	
White	1.101375	0.690107	0.1107	-	3.353986	0.979480	0.0006	-
Male	-1.057748	0.635555	0.0963	-	0.844536	0.842874	0.3165	-
Maternal ed.	0.374355	0.158679	0.0186	-	0.511142	0.226379	0.0246	-
Grade	1.655501	1.096007	0.1312	-	-0.430790	1.459526	0.7679	-
Non-focal control (nfc)	-0.800885	1.045175	0.4436	-	4.227672	1.756456	0.0162	-
Focal control (fc)	-3.141851	1.105162	0.0046	-	1.807064	1.791215	0.3131	-
Non-focal exp. (nfe)	0.170537	0.833661	0.8380	-	2.758187	1.027448	0.0073	-

Random Effects								
Level 2 Variation	4.671166	2.009493	0.0202	-	28.892088	7.069820	<.0001	-
Level 1 Variation	51.621152	3.287248	<.0001	-	88.193349	5.671292	<.0001	-
Comparisons								
FE vs FC	3.141851	1.105162	0.0046	-	-1.807064	1.791215	0.3131	-
FE vs NFE:	-0.170537	0.833661	0.8380	-	-2.758187	1.027448	0.0073	-
FC vs NFC:	-2.340966	1.088731	0.0318	-	-2.420608	1.411876	0.0867	
NFE vs NFC:	0.971421	1.001282	0.3320		-1.469485	1.735720	0.3973	